The Mechanical Properties and Corrosion Resistance in Nitric Acid of Welded Joints of Certain Titanic Alloys

SOV/125-59-10-3/16

Type VT3-1, for purposes of comparison. Corrosion tests in 99% HNO_3 were then conducted on test-pieces of the above-mentioned alloys and joints, with flux Type AN-T1 and electrode wire Type VT-1, at a temperature of 50°C. The test-pieces were of 2 kinds - unloaded, dimensions 50 x 25 x 2-3.5mm, and under pressure, dimensions 150 x 15 x 2-3.5mm (see Fig 5), and were subjected to pressure equal to 80% of the yield point of the alloy or joint. The experiments, which were carried out in liquid and gaseous HNO_3, showed that neither kind of test-piece underwent any corrosive effects in 99% liquid HNO_3, loss of weight being nil, and the results of tests in gaseous HNO_3 are given in Table 4; in this case all the alloys tested, including titanium, were subject to corrosion. Fig 5 shows a general view of a welded test-piece of VT5 alloy after being tested in 99% gaseous HNO_3 (the crack appearing along the welded seam), while a test-piece of VT5 alloy, tested under similar

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The Mechanical Properties and Corrosion Resistance in Nitric Acid of Welded Joints of Certain Titanic Alloys SOV/125-59-10-3/16

conditions, is shown in Fig 6 for comparison. Polarization curves were set up in order to throw light on the corrosive processes in titanium and its alloys. The system described in Ref 9 was somewhat altered, and as an example Fig 7 gives cathode and anode polarization curves for 99% liquid HNO_3 on technical titanium and the alloy VT3-1, indicating that a protective film is formed on the test-pieces, preventing the cathode process from reaching them, while in the case of gaseous HNO_3 considerable cathode polarization is to be observed. The author closes with an appeal for further research on this subject, and sums up the main points of the article. There are 4 tables, 3 graphs, 1 diagram, 3 photographs, and 10 references, 9 of which are Soviet and 1 American.

ASSOCIATION: Ordena trudovogo krasnogo znameni institut elektrosvarki imeni Ye.O. Patona AN USSR (Order of the Red Banner of Labor Institute of Electric Welding imeni Ye.O. Paton AS UkrSSR)

Card 4/5

The Mechanical Properties and Corrosion Resistance in Nitric Acid SOV/125-59-10-3/16
of Welded Joints of Certain Titanic Alloys

SUBMITTED: April 10, 1959.

Card 5/5

18(2), 25(1) SOV/125-12-4-5/18

AUTHORS: Gurevich, S.M., Candidate of Technical Sciences, and Grabin, V.F., Engineer

TITLE: Weld Ageing for Two-Phase Titanium-Alloy, Alloyed With Aluminum and Vanadium

PERIODICAL: Avtomaticheskaya svarka, 1959, Vol 12, Nr 4, pp 36-46 (USSR)

ABSTRACT: The authors give an investigation of the structure and The mechanical characteristics of welds of a titanium-alloy which contains about 6% Al and 4% V. The investigation was made after hardening and the following ageing at different temperatures. In several cases by electronic-microscope investigation a brittle ω-phase was found in the metal of the weld. Maximum hardness, plasticity and viscosity can be reached by a short-time ageing at the temper, from 30 to 75 minutes. By rising the temperature of temper the ageing, which is necessary to reach the maximum hardness will be decreased. Maximum content of β-phase, which will be done by hardening, is about 10%. In the welds of the

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SOV/125-12-4-5/18

Weld Ageing for Two-Phase Titanium-Alloy, Alloyed With Aluminum and Vanadium

alloy type VT 6 the ω-phase has the character of an intermediate-phase, which in the first stage of dissotiation develops a meta-stable β-phase. At long-time ageing in the welds the ω-phase will practically be eliminated. The plasticity and viscosity will increase. There are 4 graphs, 4 tables, 12 photographs and 23 references, 4 of which are Soviet, 15 English and 4 German.

ASSOCIATION: Ordena trudovogo krasnogo znameni institut elektrosvarki im. Ye.O. Patona AN USSR (Institute of the Order of the Red Banner of Labor for Electric Welding imeni Ye.O. Paton, AS UkrSSR)

SUBMITTED: December 25, 1958

Card 2/2

18(7) SOV/125-12-6-6/14

AUTHOR: Gurevich, S.M., Candidate of Technical Sciences

TITLE: Welding of Molybdenum (Literature Survey)

PERIODICAL: Avtomaticheskaya svarka, 1959, Vol 12, Nr 6 (75) pp 36-48 (USSR)

ABSTRACT: The article presents a survey of the most interesting literature of foreign countries on the welding of molybdenum. The author also presents literature on the producing, the physical and the chemical qualities of molybdenum. Foreign literature on welding in inactive gas is discussed. There are 4 photographs, 2 graphs, 6 tables and 33 references, 3 of which are Soviet, 29 English and 1 German

ASSOCIATION: Ordena trudovogo krasnogo znameni institut elektrosvarki imeni Ye.O.Patona (Institute of Electric Welding imeni Ye.O. Paton of the Order of the Red Banner of Labor).

Card 1/1

SUBMITTED: February 10, 1959

PHASE I BOOK EXPLOITATION SOV/4508

Akademiya nauk SSSR. Institut metallurgii

Titan i yego splavy, vyp. 3: Metallovedeniye titana (Titanium and Its Alloys, No. 3: Metal Science of Titanium) Moscow, Izd-vo AN SSSR, 1960, 161 p. Errata slip inserted. 2,700 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A.A. Baykova.

Resp. Ed.: N.V. Ageyev, Corresponding Member, Academy of Sciences USSR; Ed. of Publishing House: M.L. Podgoyetskiy; Tech. Ed.: Ye. V. Makuni.

PURPOSE: This collection of articles is intended for scientific research workers and metallurgical engineers.

COVERAGE: The articles summarize results of experimental studies of titanium-base alloys. The microstructure and mechanical properties of titanium-base alloys containing aluminum, chromium or other metals are analyzed along with the effect of oxygen, hydrogen and heat treatment on alloy structure and properties. The tendency of titanium alloys to embrittlement as a result of strain aging is emphasized, and the nitriding of titanium, carried out to increase the surface strength and wear resistance of titanium alloys, is described. Transformations occuring in commercial titanium under conditions of electric heating are examined. Attempts to develop titanium-base alloys capable of withstanding temperatures over 400°C are discussed as are problems of titanium-powder metallurgy and weldability of certain titanium-base alloys. No personalities are mentioned. Most of the articles have bibliographic references, the majority of which are Soviet.

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GUREVICH, S.M.

PHASE I BOOK EXPLOITATION SOV/5078

Akademiya nauk URSR, Kiyev. Instytut elektrozvaryuvannya·

Vnedreniye novykh sposobov svarki v promyshlennost'; sbornik statey. vyp. 3. (Introduction of New Welding Methods in Industry; Collection of Articles. v. 3) Kiyev, Gos. izd-vo tekhn. lit-ry UkrSSR, 1960. 207 p. 5,000 copies printed.

Sponsoring Agency: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki imeni akademika Ye. O. Patona Akademii nauk Ukrainskoy SSR.

Ed.: N. Pisarenko; Tech. Ed.: S. Matusevich.

PURPOSE: This collection of articles is intended for personnel in the welding industry.

COVERAGE: The articles deal with the combined experiences of the Institut elektrosvarki imeni Ye. O. Patona (Electric Welding Institute imeni Ye. O. Paton) and several industrial enterprises in solving scientific and engineering problems in welding technology. Problems in the application of new methods of mechanized welding and electroslag welding in industry are discussed. This is the third collection of articles published under the same title. The Foreword was written by B. Ye. Paton, Academician of the Academy of Sciences Ukrainian SSR and Lenin prize winner. There are no references.

TABLE OF CONTENTS:

Iskra, A. S. [Engineer], Yu. A. Sterenbogen [Candidate of Technical Sciences], V. M. Khrunizhe [Engineer, Electric Welding Institute imeni Ye. O. Paton], D. P. Antonets [Engineer, Zhdanovskiy zavod imeni Il'icha (Zhdanov Plant imeni Il'ich)], V. I. Rabinovich [Engineer, Barnaul'skiy kotel'nyy zavod (Barnaul Boiler Plant)], and V. V. Chernykh [Engineer, New Kramatorsk Machinery Plant]. Electroslag Welding of Steel-Plate Structures 17

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Gorbunov, O. V. [Engineer, Electric Welding Institute imeni Ye. O. Paton], P. A. Zasko [Head of Welding Laboratory, VNIIST], and A. N. Yurvanev [Chief of the Bureau for Gas-line Construction of Glavgaz SSSR (Main Administration of the Gas Industry USSR)]. Mechanized Methods of Welding Main Gas Pipelines 74

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67703

SOV/125-60-2-5/21

AUTHORS: Gurevich, S.M. and Grabin, V.F.

TITLE: The Heat-Affected Zone in the Arc Welding of Titanium Alloys

PERIODICAL: Avtomaticheskaya svarka, 1960, Nr 2, pp 51-61 (USSR)

ABSTRACT: The heat cycle in the heat-affected zone in the arc welding of titanium alloys is here studied, and the dependence of the structure and mechanical properties on the welding process and type of alloy is determined. Experimental data shows that titanium alloys with iron, chrome and manganese are more prone to cracks in the heat-affected zone than alloys with molybdenum, vanadium, and niobium. Data from literature on the subject (Soviet, English, German) is given. It is mentioned that alloys with a stable beta-phase [Ref. 11 and 12], seem highly promising for use in structures from which high performance is required. The experimental

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APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000617420014-6"

67703

SOV/125-60-2-5/21

The Heat-Affected Zone in the Arc Welding of Titanium Alloys

techniques used are described. The following conclusions are drawn. Titanium alloys, as well as technical titanium, are greatly inclined to increase the grain size in the superheated section of the heat-affected zone. Alloys containing a large quantity of β-stabilizing elements differ from α-alloys and low-alloy $\alpha + \beta$ - alloys in that their grains in the heat-affected zone are smaller. As the metastable β-phase increases, the sensitivity of the structure of the heat-affected zone to the welding conditions increases, and the toughness of the zone drops. Alloys which are alloyed with β-stabilizing elements (which form with titanium intermetal compounds) are the most inclined to form cold cracks in the heat--affected zone. In such alloys, therefore, the permissible concentration of alloying elements is lower than for alloys containing elements which form with titanium a continuous line of solid solutions. There

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67703
SOV/125-60-2-5/21

The Heat-Affected Zone in the Arc Welding of Titanium Alloys

are 3 tables, 6 graphs, 3 sets of photographs, and 16 references, of which 7 are Soviet, 7 English, and 2 German.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut electrosvarki im. Ye. O. Patona AN USSR (Order of the Red Banner of Labor Institute of Electric Welding imeni Ye.O. Paton of the AS Ukr SSR).

SUBMITTED: October 8, 1959

Card 3/3

GUREVICH, S.M.

Metallurgical processes in titanium welding. Titan i ego splavy no.3:124-134 '60. (MIRA 13:7)

(Titanium--Welding)

S/125/60/000/05/07/015

AUTHORS: Gurevich, S. M., Didkovskiy, V. P., Matveyev, A. P., and Os'mushkin, V. K.

TITLE: Experience with Electroslag Welding for Welding Rings of "VT6" Titanium Alloy

PERIODICAL: Avtomaticheskaya svarka, 1960, No. 5, pp. 56-61

TEXT: Thick titanium alloy rings and flanges used in chemical and some other industries were welded up to now on resistance butt welding machines like the "MSGA-300" (Ref. 1), and the quality of the joints was not always satisfactory. The article gives a detailed description of the electroslag process used for joining rings, 1,500 mm in diameter and 95x75 mm cross section, consisting of two forged halves, with forged plate electrodes of same "VT6" titanium alloy; work was done on an "A-550" welding machine designed by the Electric Welding Institute with a single-phase "TShS-3000-1" transformer. The information includes details on the preparation of "AN-T2" flux for this purpose, on the chemical composition of the parent metal, on electrode and weld (Table 1); photographs of joints and microstructure of the weld, and detailed engineering recommen-

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S/125/60/000/05/07/015

Experience With Electroslag Welding for Welding Rings of "VT6" Titanium Alloy

dations as to how to eliminate weld defects in the process. The technique can easily be learned by operators. The process will be employed for series production of welded "VT6" alloy rings. There are 4 photographs, 2 tables, and 3 Soviet references.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye. O. Patona AN USSR (Red Banner of Labor Electric Welding Institute imeni Ye. O. Paton AS UkrSSR) (S. M. Gurevich and V. P. Didkovskiy); Kuybyshev (A. P. Matveyev and V. K. Os'mushkin)

SUBMITTED: January 12, 1960

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Card 2/2

S/129/60/000/009/007/009
E193/E483

AUTHORS: Gurevich, S.M., Candidate of Technical Sciences and Grabin, V.F., Engineer

TITLE: The Omega Phase in Welded Seams of Alloy VT6

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1960, No.9, pp.29-38 + 1 plate

TEXT: The object of the investigation, described in the present paper, was to study the mechanical properties, structure and constitution of the welded seam in a two-phase titanium alloy subjected to ageing treatment, during which the formation of the brittle omega phase can take place as a result of the following series of transformations:

$$\beta \rightarrow \beta + \omega \rightarrow \beta + \omega + \alpha \rightarrow \beta + \alpha$$

The alloy chosen for this purpose was the hardenable VT6 alloy in the heat-treated condition, containing 6.3% Al, 3.8% V, 0.18% Fe, 0.09% Si, 0.087% O, 0.005% H, 0.04% N and 0.05% C. The experimental specimens consisted of butt-welded sheets 2.5 to 3 mm thick; welding was carried out under the cover of the AN-T1

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E193/E483

The Omega Phase in Welded Seams of Alloy VT6

flux with the aid of welding electrodes made of technical titanium VT1, alloy VT6 and a single-phase alloy VT5-1, the latter material containing only those alloying additions that stabilize the α-phase, i.e. 3.8% Al and 2.8% Sn. Specimens, cut from the welded seam (1) immediately after welding, (2) after welding and ageing at 200, 300 and 400°C for various times and (3) after welding, followed by quenching from the two-phase region (850 to 900°C) and ageing, were used for hardness measurements, impact, tensile and bending tests, metallographic examination (on both optical and electron microscopes) and X-ray analysis. The following conclusions were reached: 1) The brittle omega phase can be formed in the welded seam of the VT6 alloy when it is subjected to heat treatment consisting of quenching and ageing. The formation of the omega phase is accompanied by an increase in hardness and decrease in ductility and impact strength of the alloy. 2) The omega phase, found in the welded seams of the VT6 alloy, constitutes an intermediate product of the first stage of decomposition of the metastable β-phase. Maximum quantity of the omega phase was found in the seam whose composition was nearest to that of the

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S/129/60/000/009/007/009
E193/E483

The Omega Phase in Welded Seams of Alloy VT6

welded metal, and minimum in weld prepared with the aid of electrode made of technical titanium. 3) After a prolonged treatment at the ageing temperature, the omega phase, formed initially in the solution-treated two-phase welds, disappears as a result of which ductility and impact strength of the weld increase. 4) The structural changes taking place in welded seams of alloy VT6 during ageing cannot be revealed with the aid of the optical microscope and small quantities of the omega phase cannot be detected even by X-ray analysis. However, the growth of this phase in the welded seam, quenched from the single-phase region and aged for a short period, can be detected with the aid of the electron microscope. There are 5 figures and 19 references: 3 Soviet, 12 English, 3 German and 1 French.

ASSOCIATION: Institut elektrosvarki AN USSR imeni akad Ye.O.Patona (Institute of Electric Welding AS UkrSSR imeni Acad. Ye.O.Paton)

Card 3/3

S/125/60/000/009/008/017
A161/A130

1.2310 2708, 2808, 1573

AUTHORS: Gurevich, S.M., Nazarenko, O.K., Timchenko, V.A.

TITLE: Electron-Beam Welding Unit for Refractory and Chemically Active Metals

PERIODICAL: Avtomaticheskaya svarka, 1960, No. 9, pp. 48-53

TEXT: Detailed description is given of an electron-beam welding unit for straight and annular seams on cylindrical work up to 700 mm in diameter and 1200 mm length (Fig. 1), developed at the Electric Welding Institute im. Ye.O. Paton. The chamber of 3200 mm length and 1020 mm diameter is made of killed low-carbon steel 12 mm thick; the chamber inside is ground and all parts chrome-plated. The front end opens for placing work, and two shafts are passed into the chamber through the rear end cover (Fig. 2): one has a screw thread for moving the carriage with work in the chamber, and the other bears a pinion to rotate work. The electron gun is installed on the flange (see Fig. 1). Two inspection windows with lead glass are provided in the

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A161/A130

Electron-Beam Welding Unit for Refractory and Chemically Active Metals

chamber wall. The vacuum system has a fore vacuum pump ВН-1 (VN-1), a high-vacuum ВА-5-4 (VA-5-4) unit (converted Н-5Т (N-5T) steam-oil pump), two fore-vacuum valves with 90 mm diameter aperture, and a ДУ-380 (DU-380) vacuum gate. The vacuum system produces rarefication up to $7 \cdot 10^{-6}$ mm Hg. It takes 50-60 min to replace the work and produce a vacuum. The electron gun gives a sharp-focused beam of over 500 ma and up to 20 kv. No special biological protection is necessary. The combination focusing system has a primary electrostatic lens and a secondary electromagnetic lens producing a beam of 1 mm diameter at the weld, with up to 10 kva power. The gun is lowered into the chamber through the mentioned flange; insert rings are used for varying the distance to the work. The gun is illustrated in diagram (Fig. 5). The electric system of the unit consists of two parts: feed circuit of the electron gun (Fig. 6) and auxiliary control circuits. The gun feed system includes a 50 kva transformer with secondary voltage of 22 kv; a 25 kva potential regulator smoothly adjusting the primary transformer

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A161/A130

Electron-Beam Welding Unit for Refractory and Chemically Active Metals

voltage between 20 and 400 volt; a Larionov kenotron rectifier with В1-0,1/40 (V1-0.1/40) kenotrons; УИП-1 (UIP-1) rectifiers feeding the gun cathode heater and the electromagnetic focusing lens, adjusting output voltage in the 20-600 volt range at a maximum current of 600 ma (one rectifier is connected to a 220 volt network through a 1:1 transformer with insulation between windings, designed for rated 30 kv tension); a heating transformer for heating the flat tungsten spiral of the cathode group (220/20 volt, 100 amp); a smoothing LC filter consisting of a 3 microfarad capacitor and a 25 henry 1 amp choke instruments (milliampermeters, an ampermeter, a voltmeter, and a kw-meter). The control system includes magnetic starters, intermediate relays and contactors, autotransformers etc., all placed in a separate instrument box and in the operator's control board. The welding process is watched on instruments in a central instrument cabinet including auxiliary electronic equipment (the UIP-1 sources, the heating transformer, the cathode heating unit, etc.). Welding of molybdenum and

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S/125/60/000/009/008/017
A161/A130

Electron-Beam Welding Unit for Refractory and Chemically Active Metals

other chemically active metals has been tried with success. There are 6 figures and 3 references, 2 of which are Soviet and 1 English.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni institut elektrosvarki im. Ye.O. Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" of the Academy of Sciences of the UkrSSR)

SUBMITTED: April 29, 1960

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21909

S/125/60/000/011/004/016
A161/A133

18.8300 1138 1573 also 1416

AUTHORS: Yagupol'skaya, L.N., Gurevich, S.M.

TITLE: Corrosion of titanium alloy welds in mineral acids

PERIODICAL: Avtomaticheskaya svarka, 13 no. 11, 1960, 18-24

TEXT: The Electric Welding Institute has studied the corrosion behavior of five titanium alloys in sulfuric and hydrochloric acid. The alloys were: BT5-1 (VT5-1), titanium-aluminum-stannum OT-4 (OT-4), titanium-aluminum-manganese; T-3 and T-4 (T-3 and T-4), titanium-iron-chrome-aluminum-silicon; and ИМП-7 (IMP-7), titanium-aluminum-vanadium. The IMP-7 was a powder metal, the others were produced by arc melting in a vacuum furnace. Metal of up to 2 mm depth was welded by the argon arc method; alloys of 2.5-3 mm depth by submerged arc under AH-T1 (AN-T1) flux, with BT1 (VT1) wire. Corrosion test specimens were strung on a plastic pipe and isolated by porcelain beads. The corrosive medium were sulfuric and hydrochloric acid solutions of various concentration. For prolonged tests hydrochloric acid concentrations of 1, 3.5, and 5% were used (7% solution destroyed titanium alloys rapidly). The

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21909

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A161/A133

Corrosion of titanium alloy welds...

selected concentrations of sulfuric acid are the most characteristical - 5% and 40% causing considerable destruction of commercial titanium, and 60% in which titanium and titanium welds are corrosionproof (Ref.6). The tests lasted 100 hours. The results are illustrated in diagrams (Fig.2 and 3), from where it can be seen that in sulfuric acid solutions the resistance of welds and base metal is nearly equal, and in hydrochloric acid the corrosion rate of welds is slightly higher than that of base metal. No changes were revealed in the crystalline structure of welds or base metal from the corrosion tests. The corrosion-resistance of welds made by the argon arc and submerged arc process was practically equal. All five alloys proved corrosion resistant with a corrosion rate of less than 0.13 mm/year) in 1-% hydrochloric acid solution at 50°C; a concentration increase to 3.5 and 5% caused a much higher corrosion rate in alloys, but not in commercial titanium which remained resistant. In 5-% sulfuric acid the corrosion rate of the alloys was high and differed not very much, but commercial titanium corroded 2-2.5 times faster than the alloys. In 60-% sulfuric acid all alloys and welds were satisfactorily resistant. The different behavior of commercial titanium and titanium alloys is explained by different formations of protective surface films. There are 5 figures and 10 references: 8 Soviet and 2 non-

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21909
S/125/60/000/011/004/016
A161/A133

Corrosion of titanium alloy welds...

Soviet.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im.Ye. O.Patona AN USSR ("Order of the Red Banner of Labor" Electric Welding Institute im.Ye.O.Paton of the Academy of Sciences of the UkrSSR)

SUBMITTED: April 14, 1960

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Card 3/5

PHASE I BOOK EXPLOITATION SOV/5228

Gurevich, Samuil Markovich, Candidate of Technical Sciences

Novyye metody svarki (New Welding Methods) Moscow, Izd-vo "Znaniye", 1961. 46 p. 47,000 copies printed. (Series: Vsesoyuznoye obshchestvo po rasprostraneniyu politicheskikh i nauchnykh znaniy. Seriya IV, 1961. Tekhnika, no. 6)

Ed.: T. F. Islankina; Tech. Ed.: A. S. Nazarova.

PURPOSE: This booklet is intended for general readers interested in the development of welding methods.

COVERAGE: Various methods of mechanized welding, including electron-beam welding, high-frequency resistance welding, electroslag welding, and other newly developed methods are discussed. New welding equipment developed by the Institut elektrosvarki imeni akademika Ye. O. Patona Akademii nauk Ukrainskoy SSR (Electric Welding Institute imeni Academician Ye. O. Paton of the Academy of Sciences UkrSSR) is briefly described. No personalities are mentioned.

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APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000617420014-6"

GUREVICH, S. M.

"Problems in Welding Titanium and Other Active Metals,'

report presented at the 2nd Intl. Colloquium on Weldability and Welding Metallurgy of Nonferrous Metals, Weimar, 2-3 March 1961

Inst. for Electrowelding im Ye. O. Paton, Kiev, Ukr SSR

APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000617420014-6"

22235

S/125/61/000/001/007/016
A161/A133

1.2300 also 1573

AUTHORS: Didkovskiy, V.P., Gurevich, S.M.

TITLE: Electro-slag welding of titanium with wire electrodes

PERIODICAL: Avtomaticheskaya svarka, no. 1, 1961, 48-51

TEXT: The electro-slag welding process with plate electrodes is used in industry for joining titanium and titanium-alloy parts of large cross sections, but plate electrodes are not suitable for long seams because of the high electric resistance of commercial titanium, which causes a heating of the plate and consequently saturation of the electrode metal with gas that spoils the weld. Experiments with long seams were carried out at the Electric Welding Institute im.Ye.O.Paton with wire electrodes. Commercial ВТ1 (VT1) titanium plates 40-50 mm high were joined by filling a 25-28 mm wide gap between them with a single wire and АН-Т2 (AN-T2) flux. Transverse oscillation of electrode wire was not employed. Alternating current was supplied from a ТШС-3000-1 (TShS-3000-1) transformer. The welding zone was shielded with X

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S/125/61/000/001/007/016
A161/A133

Electro-slag welding of titanium ...

argon. Wire from VT-1 titanium 3, 4 and 5 mm in diameter was tested. The best results were obtained with 4 mm wire, a welding current of 550-600 amp, 22-24 v, an electrode feed of 200 m/hour, and a slag depth of 30-35 mm. The welds were sound (Fig.1). The microstructure of the weld metal (Fig.2) was same as in welding with plate electrodes, its hardness slightly exceeding that of base metal, which seems to be due to the acicular structure of the seam. The difference in hardness between the center and the outside of the weld was only slight, and no contamination with oxygen, nitrogen and hydrogen during the process was stated. The mechanical properties of welded joints were close to those of base metal. It seems that standard equipment used for welding steel can be employed for titanium if some details are changed (design of the water-cooled slides, nozzles, and more). The transformer must have a rigid characteristic and low idle-run voltage, such as the TShS-3000-1 or TShS-3000-2 types. Conclusions: 1) The welding of heavy plate titanium by the electro-slag process with wire electrodes is possible. Optimum results are obtained with 4 mm wire. 2) Welds in commercial titanium have the same strength as the base metal. Their ductility and toughness is sufficient. There are 3 figures and 5 Soviet-bloc references.

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S/125/61/000/001/007/016
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Electro-slag welding of titanium ...

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im.Ye. O.Patona AN USSR ("Order of the Red Banner of Labor" Electric Welding Institute im.Ye.O.Paton AS UkrSSR)

SUBMITTED: May 17, 1960

Card 3/4 3

22937
S/125/61/000/006/001/010
D040/D112

1.1710 also 2708

AUTHORS: Grabin, V. F., Gurevich, S. M., Rafalovskiy, V. A., Trefilov, V. I.

TITLE: Investigation of ageing processes in biphase titanium alloy welds. II installment. - Ageing of heat treated welds

PERIODICAL: Avtomaticheskaya svarka, no. 6, 1961, 3-13

TEXT: Results of investigation of the structure and mechanical properties of titanium alloy welds in the initial state were presented by the authors in instalment I (Ref. 3: "Avtom.svarka", no. 4, 1961). The II instalment presents the results of investigations made after heat treatment consisting in heating specimens to 800-900°C, quenching in water, and subsequent ageing at 200-600°C in evacuated quartz ampoules. The studied alloys were commercial BT 6 (VT6)(Ti-Al-V system) and two experimental compositions - No. 1 (Ti-Al-V-Mn) and No. 2 (Ti-Mn). The reason for the investigation is the ever more extensive application of high-strength biphase titanium alloys for welded structures, and the embrittlement in welds. The chemical composition and properties of the three studied alloys were given in Ref. 3. The

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S/125/61/000/006/001/010
D040/D112

Investigation of ageing processes ...

ageing process was studied by measurements of hardness, electric resistance and thermal expansion, and with X-ray and electron microscope observations. The results are discussed with references to data of seventeen other works, Soviet and foreign. The minimum hardness was established in VT6 alloy welds with the lowest quantity of β (10%) after quenching; in mixed and structure it reached 550-600 Hv. Maximum hardness was reached faster at a higher ageing temperature. In VT6 the maximum hardness depended only little on the quenching temperature, but in the No. 1 and 2 alloys this dependence was more pronounced. The formation of ω upon isothermic decomposition was accompanied by volume reduction of specimens and change of the sign of the temperature coefficient of electric resistance. After sufficiently long holding periods ω decomposed forming dispersed α particles; this was accompanied by a reduction in hardness and an increase in the volume and plasticity of the specimen. Decomposition of β above 400-450°C was characterized by C-curves similar to those of the pearlitic decomposition of supercooled austenite (Fig. 2), but the start of ω separation had not the characteristical C-shaped line, for some amount of $\beta \rightarrow \omega$ transformation took place even at very rapid heating (up to 3000°C/sec, in alloys with a β-composition close to critical electronic concentration). The high-hardness stage

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Investigation of ageing processes ...

passed very rapidly when the ageing temperature was sufficiently high, thus hardness decreased during isothermic soaking at 600°C. No sufficient homogeneity was obtained by heating to 800°C for quenching, for this temperature is near the upper limit of the biphase ($\alpha + \beta$) range. At 900°C homogenation is already possible, and the β-phase becomes less alloyed and decomposes faster in ageing. Contrary to the opinion of some foreign authors, it had previously been concluded by Soviet authors that at a certain electronic concentration in β the $\beta \rightarrow \omega$ transformation is without diffusion, and that the reverse martensite-like transformation (also diffusionless) could not be suppressed even by heating at a rate of several thousand degrees per second. This cannot be compared with the "reverse" in Co-Al alloys. The initial transformation in alloys whose β-phase structure has a near-critical electronic concentration must be presented as shown by the dotted line in Fig. 5, and not as it is presented usually. In alloys with omega already present after quenching, the initial ($\beta \rightarrow \omega$) transformation line will be the same. As it is not possible to fix precisely the start of decomposition in the case of furnace heating, the specimens were heated by electric resistance in a high-speed dilatometer. They were heated for 1 - 1.5 sec, then soaked for 90 secs. The results show that no transformation took place in

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VT6 alloy, i.e. the specimens' length decreased only slightly, but in the No. 1 and No. 2 alloys the transformation was sharp and without any incubation period. It is important from the practical point of view to know the boundaries of the temperature range where the ω phase exists. The obtained data indicate that for the VT6 it is 180-420°C, and for No. 1 and No. 2 - 180-440°C. Seen under an electron microscope, the ω particles were mostly round. The included photomicrographs show no ω in No. 1 alloy welds after quenching (Fig. 7, a) (hardness was H_V 300-320); the No. 2 had a slight quantity of ω and high hardness (H_V 400). After 1 hr ageing at 350°C both alloys had clear round ω-phase particles 300-500 Å in size. Elongated 500-800 Å long particles were more rare. It is possible that they formed later, when the particles were only slightly growing. Long ageing ends with full transformation into alpha. In general, the data show that the quenching temperature should not be above 900°C as this reduces the plasticity of weld metal both after quenching as well as after ageing. Brief ageing of preliminarily quenched specimens raised the ultimate strength to 130 kg/mm^2 and considerably decreased the plasticity. Long ageing improved the plasticity of weld metal and only slightly decreased the strength, i.e. to 120 kg/mm^2. Conclusions. 1) The decomposition process of the metastable β-phase

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Investigation of ageing processes ...

in hardened welds of VT6, No. 1 and No. 2 alloys has been investigated. The transformation kinetics of β in ageing of quenched welds in biphase titanium alloys is analogous with the β-decomposition in the weld metal and heat-affected zone after welding. The ageing process is faster in hardened welds than in welds not subjected to preliminary heat treatment. 2) Diagrams of metastable β-phase decomposition have been plotted for the No. 1 and 2 alloys, and the decomposition mechanism discussed. 3) The $\beta \longrightarrow \omega$ transformation rate upon ageing of weld metal depends on the temperature of the preceding quenching. Lowering the quenching temperature from 900 to 800°C speeds up the ageing process in the VT6 alloy. In the No. 1 and 2 alloys the effect is opposite. 4) VT6 alloy welds are less prone to ageing than welds of No. 1 and 2 alloys, both after welding and after quenching. 5) Omega particles forming in the weld metal upon ageing are round, seldom elongated. Their respective size is 300-500 Å and 500-800 Å. 6) Quenching and subsequent long ageing of VT6 welds give an ultimate strength of up to 120 kg/mm^2 and satisfactory plasticity. There are 7 figures, 1 table and 17 references: 7 Soviet-bloc and 10 non-Soviet bloc. The four latest references to English-language publications read as follows: F. R. Brotzen, E. L. Harman and A. R. Troiano, Decomposition of Beta Titanium, "Journal of Metals",

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S/125/61/000/006/001/010
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Investigation of ageing processes ...

v.7, No. 2, 1955; F. R. Brotzen, E. L. Harmon, A. R. Troiano, Trans. AIME, v. 203, 1955; R. T. Jaffee, Prog. Metal Phys., 7, Revue, 1958; I. M. Silcock, An X-ray Examination of the Phase in TiV, TiMo and TiCr Alloys, "Acta Metallurgica", No.7, 6, 1958.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye. O. Patona AN USSR (Institute of Electric Welding "Order of the Red Banner of Labor" im. Ye. O. Paton AS UkrSSR) (V. F. Grabin, S. M. Gurevich); Institut metallofiziki AN USSR (Institute of Physics of Metals AS UkrSSR) (V. A. Rafalovskiy, V. I. Trefilov)

SUBMITTED: January 24, 1961

Card 6/8

1.2300
18.1285

27032
S/125/61/000/004/001/013
A161/A127

AUTHORS: Grabin, V. F., Gurevich, S. M., Rafalovskiy, V. A., Trefilov, V. I.

TITLE: Investigation of aging processes in welds on biphase titanium alloys. Instalment I - Aging of welds in the post-welding state

PERIODICAL: Avtomaticheskaya svarka, no. 4, 1961, 3 - 12

TEXT: The purpose of the described investigation was to compare aging processes in biphase titanium alloys with different additions of β-stabilizers. Welds were studied in the as-welded state, and after heat treatment. The three experiment alloys were the commercial BT6 (VT6) with 6.1% Al and 4.1% V, and two test alloys designated no. 1 and containing 2.5% Al, 9.7% V and 3.8% Mn, and no. 2 - with 6.34% Mn. The investigation methods were the following: metallographic, electron-microscopic, X-ray, dilatometric, measurement of electric resistance and hardness, and tests for mechanical properties. Collodium, carbon and silver-carbon prints were used for examination with the УЭМ-100 (UEM-100) electron microscope. The phase composition was determined roentgenographically with copper radiation and nickel filters. The differential vacuum dilatometer had been described formerly [Ref. 11: V. F. Grabin, V. G. Vasil'yev, V. A. Rafalovskiy, "Avtom. svarka",

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Investigation of aging processes in welds on...

no. 3, 1960]. The electric resistance was measured in a high-temperature vacuum unit. Heating for heat treatment and artificial aging was produced in evacuated quartz ampoules. Welded specimens were prepared by joining 3 to 6 mm thick sheets by butt welding with electrodes of the same metal as the base metal, by submerged arc with АН-Т1 (AN-T1) flux. The article presents the first part of results - obtained with welds that were not heat-treated. Graphs and electron microscope photo-micrographs are included. The formation of the phase omega was observed in the no. 2 alloy only (Ti-Mn), directly after the welding. The test results confirmed previous conclusions concerning the stability of welds on VT6 alloy [Ref.14: S. M. Gurevich, V. F. Grabin, "Avtom. svarka", no. 4, 1959]. The article includes references to Soviet-bloc and non-Soviet-bloc publications in connection with data on embrittlement in titanium alloy welds. Conclusions: 1) The possibility of ω-phase formation in weld metal and the adjacent heat-affected zone in binary Ti-Mn alloys (no. 2) has been experimentally proven. The formation of this phase directly after welding causes embrittlement. 2) The ω-phase seen in the electron microscope has the shape of round or oblong segregations that are distributed non-uniformly. The segregations were, as a rule, observed inside grains. 3) The ω-phase was not found in welds that contained β-stabilizers (vanadium and manganese aggregate content as in the no. 1 alloy), and an α-stabilizer (aluminum). But

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weld metal alloyed with manganese alone was highly prone to aging accompanied with
the formation of ω-phase. 4) Aging was most intensive in the 200 - 450°C tempera-
ture range. Long isothermic soaking (to 100 hours) did not eliminate brittleness,
which is apparently caused by the α-phase segregation on grain boundaries as a
result of the $\beta + \omega \rightarrow \beta + \alpha$ transformations. 5) Welds in the VT6 alloy in the
post-welding state are sufficiently stable and do not embrittle in artificial ag-
ing in the 200 - 500°C range. Hence it is wrong to use high-temperature treatment
for the VT6 alloy welds when the required strength is not above 100 kg/mm^2. Temper-
ing for stress relief will be sufficient. There are 6 figures, 3 tables and 14
references: 4 Soviet-bloc and 10 non-Soviet-bloc. The references to the four most
recent English-language publications read as follows: E. L. Harmon, L. Kessel,
A. R. Troiano, Mechanical Properties Correlated with Transformation Characteristics
of Titanium-Vanadium Alloys, "Trans. Amer. Soc. Metals", v. 50, 1958; A. I. Griest,
I. R. Doing and P. D. Frost, Correlation of Transformation Behaviour with Mechani-
cal Properties of Several Titanium-Base Alloys, "Trans. Met. Soc. Amer. Inst. Min.",
"Metal Eng.", 215, 1959; R. W. Douglass, F. C. Holden, H. R. Ogden and R. T. Yaf-
fee, Effect of Microstructure on the Mechanical Properties of Ti-V, Ti-Al-V Alloys,
"Journal of Metals", v. 12, no. 1, 1960; A. I. Griest, A. P. Joung, A Study of
Beta Embrittlement in High-Strength Titanium Alloys, "Battelle Mem. Institute", 1958

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Investigation of aging processes in welds on... S/125/61/000/004/001/013 A161/A127

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye. O. Patona AN USSR ("Order of the Red Banner of Labor" Electric Welding Institute im. Ye. O. Paton AS UkrSSR) (V. F. Grabin and S. M. Gurevich); Institut metallofiziki AN USSR (Institute of Physics of Metals AS UkrSSR) (V. A. Rafalovskiy and V. I. Trefilov)

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1.2310

22952
S/125/61/000/007/008/013
D040/D113

AUTHORS: Medovar, B.I.; Nazarenko, O.K.; Gurevich, S.M.; Chekotilo, L.V.; Povod, A.G.; and Pinchuk, N.I.

TITLE: Some peculiarities of electron-beam welding of austenitic steels and alloys

PERIODICAL: Avtomaticheskaya svarka, no. 7, 1961, 79-81

TEXT: In their introductory remarks, the authors state why the electron-beam welding of austenitic steels and alloys in a vacuum is superior to conventional welding. For experimental purposes, specimens of ЭИ 726 (EI 726) and ЭИ696 (EI 696) heat-resistant austenitic steels and a nimonic-type ЭИ 437Б (EI437B) alloy were welded by the electron-beam method. All these types contain boron and are prone to cracks in the area near the weld and in the weld metal, if the compositon of the base metal is reproduced. Welding was carried out with an electron-beam gun designed by the Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O. Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye.O. Paton AS UkrSSR) using 120 mA, 20 kw current and a 35 m/hr welding speed. Metal X

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22952

S/125/61/000/007/008/013

Some peculiarities of electron-beam ... D040/D113

produced by the electron beam was completely sound, except in the case of EI726 steel where an increased boron content of 0.025% caused cracks to form in the base metal at the seam and sometimes even in the weld metal. The following conclusions are drawn: The new method of electron-beam welding in a vacuum must be used not only for refractory and chemically active metals but also for heat-resistant austenitic steels and alloys. The electron-beam method gives welds much more resistance to crystallization cracks than other known welding methods. It is to be expected that the use of filler wire will make the electron-beam process applicable to a wider range of austenitic steels and alloys, and that the dagger shape of the seam will necessitate some modification of the design of the joints. There are 6 figures. X

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye. O. Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye. O. Paton AS UkrSSR)

SUBMITTED: April 17, 1961

Card 2/2

26483
S/125/61/000/009/007/014
D040/D113

1.2310 2708, 2808, 3215, 1573

AUTHORS: Gurevich, S.M.; Kharchenko, G.K.

TITLE: The effect of the electron beam welding process on weld parameters

PERIODICAL: Avtomaticheskaya svarka, no.9, 1961, 38-40

TEXT: Data is presented of an investigation of variations of fusion depth in base metal and of the weld width caused by variations of electron beam current, acceleration voltage and welding speed. The P-971 (R-971) welding unit of the Institut elektrosvarki im. Ye.O.Patona (Electric Welding Institute im. Ye.O.Paton) had been described previously (Ref.3: S.M. Gurevich et al., "Avtomaticheskaya svarka", no.9, 1960). It has an improved electron gun with a combination focusing system and a tungsten spiral cathode. Welding was carried out in a vacuum chamber with $2 \cdot 10^{-5}$ mm Hg vacuum, 20-100 ma beam current, 15-22 kv acceleration voltage and 10-36 m/hr welding speed, on 5-6 mm deep plates of low-alloy OT4 (OT4) titanium. The seam depth and width variations are shown in the sets of

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APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000617420014-6"

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D040/D113

The effect of the electron ....

graphs. The minimum weld width was 2 mm, and the maximum depth 5 mm; the maximum depth-width ratio (seam shape factor) was about 1. In these experiments no attempts were made to raise the seam shape factor, but it has been stated that this is possible by raising the accelerating voltage to 50 kv and higher. The consumption of electric energy in the electron beam and argon arc welding processes is compared and it is concluded that the electron beam requires only 1.8 kva in titanium welding where the argon arc would require 3.1 kva. It is expected that electron guns with a higher accelerating voltage will improve the focusing and the welding effect. There are 2 figures and 4 references: 3 Soviet and 1 non-Soviet.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O.Patona, (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye.O.Paton, AS UkrSSR)

SUBMITTED: February 22, 1961

Card 2/2

1.2300 1573

28253
G/014/61/000/009/002/004
D027/D109

AUTHOR: Gurevich, S. M.

TITLE: Problems concerning welding of titanium and other chemically active metals

PERIODICAL: Schweisstechnik, no. 9, 1961, 394-398

TEXT: The author discusses three welding methods for welding of titanium and other chemically active metals: TIG welding, under flux welding, and the new electron-ray welding method. With respect to welding of titanium alloys, he points out that the utilization of singlepass welding or double-welding of sheets of medium thickness is one of the most important advantages of automatic submerged arc welding of titanium alloys while the employment of the TIG welding method necessitates a multipass welding process. For comparison, the author mentions the values of a butt weld of a titanium alloy with 5% aluminum addition, welded by help of the following two methods (a) by means of TIG welding with addition of a filler wire consisting of

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Problems concerning welding of ... D027/D109

unalloyed industrial titanium, welded in six passes, and (b) by means of automatic submerged arc welding with a wire of industrial titanium welded in a singlepass on a copper support. The results showed that the change from a multipass seam to a singlepass seam increased considerably the plastic values of a titanium alloy seam. Other experiments revealed that not all of the titanium alloys react equally to the heat cycle in the seam area. A maximum grain growth is characteristic for α-alloys and for the low-alloyed two-phase alloys ($\alpha + \beta$). An increase of the concentration of the β-stablizing element in the melt will noticeably reduce the grain size in the seam area. In the study of S. M. Gurevich and V.F. Grabin (Ref 4: Die Nahtübergangszone beim Lichtbogenschweissen von Titan-Legierungen [The seam transition zone in electric arc welding of titanium alloys] Avtomatitseskaya svarka (1960) no. 2, p. 51-61) it is assumed that a minimum grain size will be found in the seam area of high-alloyed, single-phase alloys with stable β-phase. The utilization of those alloys may be most suitable for constructions subjected to stress. The author states that further studies of these phenomena will lead to more reliable criteria for the sel-

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Problems concerning welding of ...

ection of optimum welding parameters. The single-phase α-alloys show a greater tendency to grain growth than the two-phase alloys. With respect to sensitivity against welding parameters, the two-phase alloys range below the α-alloys. A completely different process was observed when the total concentration of the β-stabilizers in the alloy was increased. The author points out that a hardening must be expected in the seam area of weldings of medium-alloyed titanium alloys. This phenomenon will lead to the forming of cold cracks in the seam material and within the seam area. A maximum tendency to formation of cracks was observed in welding of alloys which were alloyed with β-stabilizers which, in connection with titanium, form intermetallic compounds (iron, chromium, manganese, copper etc.). The stabilizers of the β-phase (especially manganese, iron, and chromium) increase the stability of the seam. Those elements of the β-stabilizers which form isomorphous β-systems (vanadium, molybdenum) show the least stabilizing effect on the titanium seam. The author points out that optimum values were obtained when an electrode of an α-alloy was used. The tests showed that an addition of unalloyed technically pure titanium for single-phase α-alloys, and low-alloyed alloys containing 2-3% β-stabilizing elements of a stabil-

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D027/D109

Problems concerning welding of ...

ity up to 90 kg/mm^2, gave the best results. It is, therefore, practical to use welding wire of a different chemical composition than the basic material for welding of titanium alloys. Electron-microscopic examinations of the weld of the industrial alloy WT6 (6.3% Al; 3.6% V) showed a disperse separation of small ω-phase quantities after hardening and artificial aging at a temperature of 300-400°C with brief periods of thermal retardation. Aging of previously hardened seams of the alloy WT6 showed different results depending on the welding wire used. Minimum hardness values were obtained of seams which were welded with unalloyed titanium electrodes, and through electronmicroscopic examinations it was found that these seams contained small quantities of a ω-phase. For an extended employment of extra hard titanium alloys for welding constructions it is suggested to further examine the behavior of the brittle ω-phase in welding seams. When speaking of the important factors of electron-ray welding, the author points out that the heat source of this method can be concentrated on a very small spot the diameter of which will not exceed 0.1 mm. The superiority of electron-ray welding to inert-gas welding is shown by means of the following example: 1 mm thick molybdenum sheet was butt-welded by help of two

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welding methods (1) with a nonconsumable tungsten electrode in a helium atmosphere and (2) by means of the elctron-ray method in a vacuum chamber at a vacuum of 2 x 10^{-5} mm of mercury. The welds of the first method showed little plasticity (bending angle not above 25°) while the plasticity of welds of the second method was considerably higher, whereby cross-sectional specimen of the seam revealed a bending angle of 100°. The author then briefly describes the set up of a large electron-ray welding unit, designed by the Institute of Electric Welding E.O. Paton in Kiev. This electron welding unit is equipped with electromagnetic lenses and operates with an accelerating voltage of up to 20 kV. The unit's electric current system consists of a three-phase heavy current transformer, capacity 50 kVA, a rectifier, a balanced filter LC, a potential governor, current sources with stabilizing voltage for the focusing lenses, a reheating transformer, and control and measuring devices. At the end of the report, the author summarizes the advantages of the new electron-ray welding method. He states that an intensification of the electron flow will increase the depth and width of the penetration. A certain acceleration voltage together with the other stan-

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dard welding conditions will lead to maximum penetration at a certain current value. A further increase of the current will reduce this seam parameter because of a partial disintegration of the electron beam. This shows that there exists an optimal current range in the electron device at an assumed acceleration voltage, which will guarantee most favourable focusing conditions. This current range will be determined when selecting the welding parameters. Width and depth of penetration may be controlled by changing the welding speed. An advantage of electron-ray welding is that the electron ray does not exert a pressure on the welding bath, which favors the shaping of the seam and also allows for a welding performance in cases where electric-arc welding in an inert gas atmosphere does not give positive results. There are 9 figures, 2 tables and 4 references: 3 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English language publication reads as follows: E. Walden and L.A. Dixon: Metal Progress (1953), vol 64, no. 2.

ASSOCIATION: Institut für Electroschweissung E.O. Paton der Akademie der

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Wissenschaften der Ukrainischen SSR, Kiev (Institute of Electric Welding, E. O. Paton, of the Academy of Sciences of the Ukrainian SSR, Kiev).

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GUREVICH, S.M.

Electrodes for welding titanium alloys under AN-TI flux. Avtom. svar. 14 no.5:94 My '61. (MIRA 14:5)
(Titanium alloys--Welding)

GRABIN, V.F.; GUREVICH, S.M.; RAFALOVSKIY, V.A.; TREFILOV, V.I.

Investigating weld aging processes in two-phase titanium alloys. Report no.2. Aging of welds having undergone heat treatment. Avtom. svar. 14 no.6:3-13 Je '61. (MIRA 14:5)

1. Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O. Patona AN USSR (for Grabin, Gurevich). 2. Institut metallofiziki AN USSR (for Rafalovskiy, Trefilov).

(Titanium alloys—Welding)
(Phase rule and equilibrium)

MEDOVAR, B.I.; NAZARENKO, O.K.; GUREVICH, S.M.; CHEKOTILO, L.V.; POVOD, A.G.; PINCHUK, N.I.

Some characteristics of the electron-beam welding of austenite steels and alloys. Avtom.svar. 14 no.7:79-81 Jl '61. (MIRA 14:7)

1. Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O.Patona AN USSR.
(Steel--Welding) (Electron beams)

APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000617420014-6"

22953

S/125/61/000/007/009/013
D040/D113

1.2300

AUTHORS: Gurevich, S.M. and Zagrebenyuk, S.D.

TITLE: Semiautomatic submerged arc welding of titanium

PERIODICAL: Avtomaticheskaya svarka, 14, no. 7, 1961, 82-85

TEXT: A new semiautomatic А-732 (A-732) pistol-type welder for titanium, designed by V.S.Kobylyakov, Engineer, and developed at the Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O.Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye.O.Paton AN UkrSSR) is described. High-quality joints in spots inaccessible to automatic welding machines can be reached by the A-732 welder. Up to now, the welding in such spots had to be done manually with tungsten electrodes in argon, and the quality of welds was low (cold cracks, porosity). The new welder uses thin titanium wire. The simple ПШ-5 (PSh-5) wire feed mechanism has been coupled with a d.c. motor permitting smooth speed regulation. The hose is fitted with a wear-resistant spring bronze spiral which produces little resistance to the passage of the titanium wire. The welder is fitted with replaceable spirals for feeding wire of up to 3 mm in diameter. Current is supplied from a standard ПС-300 (PS-300) or ПС-500 (PS-500) welding generator. An АН-Т1

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(AN-T1) flux was used in welding tests. Some details of the welding process are given (Table 1):

Type of joint	Electrode wire feed in m/hr	Welding current in amp	Tension in volts	Electrode throat in mm
Bilateral butt weld in 6-8 mm thick metal	162-189	200-250	32-34	14-16
Lap weld in 6-8 mm thick metal....	215	250-280	32-34	14-16
Angle butt weld, 8 x 8 mm cross section	230	280-300	34-36	14-16

The electrode wire was composed of commercial BT1-2 (VT1-2) titanium and OT4 (OT4) low-alloy titanium. The obtained welds were fully sound, and the hardness of weld and base metal differed very little, which proves the absence of contamination in the welds. The composition of the AN-T1 flux is

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S/125/61/000/007/009/013
D040/D113

Semiautomatic submerged arc welding....

not given. The following conclusions are drawn: 1) Semiautomatic submerged arc welding of titanium in an oxygen-free AN-Tl flux is possible. The mechanical properties of welds produced by the A-732 welder are practically equal to the properties of welds produced by an automatic welding machine. 2) The new A-732 semiautomatic welder has successfully passed laboratory tests and can be recommended for industrial testing. There are 2 tables, 1 figure and 3 Soviet-bloc references. X

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O.Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye.O. Paton AN UkrSSR)

SUBMITTED: March 9, 1961

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D040/D113

Semiautomatic submerged arc welding...

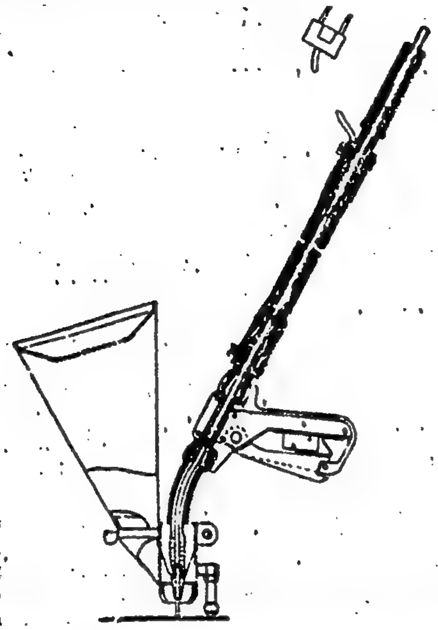

Fig. 1,b.
Cross-sectional view of the hose holder of the A-732 semiautomatic welder.

X

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GUREVICH, S.M.; KHARCHENKO, G.K.

Effect of the conditions of electron-beam welding on weld joint parameters. Avtom.svar. 14 no.9:38-40 S '61. (MIRA 14:8)

1. Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki imeni Ye.O.Patona AN USSR.
(Electric welding) (Electron beams)

S/762/61/000/000/029/029

AUTHORS: Morozov, Ye.I., Ronzhin, A.S., Prostov, I.A., Matveyev, V.S., Gurevich, S.M., Didkovskiy, V.P., Yasinskiy, K.K., Usov, V.N.

TITLE: Electroslag smelting of titanium ingots.

SOURCE: Titan v promyshlennosti; sbornik statey. Ed. by S.G.Glazunov. Moscow, 1961, 314-326.

TEXT: The paper describes a method of electrosclag smelting of Ti ingots with desirable mechanical properties and with a surface that requires almost no machining prior to plastic working. The principal objective of the development is the smelting of flat ingots for the rolling of sheet material with uniform transverse distribution of rolling deformation (cylindrical ingots are deformed more greatly at the center; tensile stresses produce edge cracking on the resulting sheets). Several organizations collaborated with the Institute of Electric Welding imeni Ye.O.Paton in 1959 in adapting the splashless electroslag method of Ti smelting (3 electrodes) developed in 1958 to the smelting of slab ingots of up to 200x800x700 mm and 500 kg. Good mechanical properties and high electric-power utilization result from the improved current- and heat-flow uniformity of the arc established underneath the protective flux layer. Since 3, as well as one, electrodes can be employed, the 3 phases of an a.c. power supply can be utilized uniformly. The fused flux layer contributes to the formation of a singularly compact ingot structure. Flux must: (1) Not contain O; (2) have a m.p. close to that of the metal and be readily fusible; (3) have a high b.p.

(not less than 2,000°C). Neutral-gas shielding above the flux is mandatory to avoid O reaction. Details of the experiments with various fluxes, which led to the adoption of CaF_2 (brand " " (Ch)) and a purifying remelt of the flux in an induction furnace prior to use, are reported and tabulated. Comparison of BT (VT) -1, -3-1, and -5, OT4, and Ti-8Mn ingots obtained by the electroslag (ES) and vacuum arc (VA) methods. Differences between ES and VA ingots initially observed were found to be attributable to the use of pressed electrodes in the ES method; use of once-VA-melted ingots as starting electrodes in both ES and VA methods yielded BT (VT) and OT ingots of practically identical mechanical properties (described and tabulated). The mechanical properties of the Ti-8Mn were considerably improved by the ES method; this is attributed to the more uniform distribution of the high-vapor-pressure Mn in the ingot under the protection of the flux. The BT (VT) and OT alloys showed either increased strength or impaired notch toughness when smelted under a fluorspar flux, probably as a result of uncontrollable admixtures contained in the fluorspar. Furnace: The design of the 3-electrode furnace, with a crystallizer, electrode chamber, flux dispenser, electrode-advance mechanism, protective shield, and power transformer, is described and illustrated (cross-section, photos); its operation and process control are described in detail. A 500-kg ingot shows the result of deliberate manual delays in electrode advance in the form of nonuniformities (photo). Design criteria were obtained for future furnace designs. There are 6 figures, 3 tables, and 2 Russian-language Soviet references identified in footnotes.

Card 2/2 ASSOCIATION: None given.

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S/125/61/000/012/001/008
D040/D112

AUTHORS: Gurevich, S.M.; Kharchenko, G.K.

TITLE: Electron-beam welding of molybdenum

PERIODICAL: Avtomaticheskaya svarka, no. 12, 1961, 4-11

TEXT: The article describes experiments in which 1-3 mm thick molybdenum plates were successfully welded by an electron-beam in a vacuum chamber. Plates of molybdenum melted in an electric vacuum furnace, as well as plates of sintered powder were used. The plates were welded by a Р-971 (R-971) electron-beam welding unit with a combined electrostatic and electromagnetic focusing system and an accelerating voltage of up to 22 kw; this unit has already been described (Ref. 3: S.M. Gurevich, O.K. Nazarenko and V.A. Timchenko, "Avtomaticheskaya svarka", No. 9, 1960). A direct-heating, tungsten-spiral cathode and an indirect-heating lanthanum boride cathode were tried for comparison. Automatic argon arc welding with a tungsten electrode in a controlled-atmosphere chamber with argon and helium was also carried out for comparison of results. The oxygen and hydrogen content in the base metal and the weld metal was determined by a method developed by V.I. Lakomskiy. Sound

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S/125/61/000/012/001/008
D040/D112

Electron-beam welding ...

high-quality welds with a smooth appearance were obtained by electron-beam welding only. Electron beam welds made with the lanthanum boride cathode were not wider than 1.5 mm, as compared with at least 4.2 mm in the case of welds produced by argon arc welding, and the heat-affected zone of the electron-beam welds was 2.8 times narrower than in the argon-arc welds. Gas contained in the metal caused spatter, particularly in welding sintered powder molybdenum. It was found imperative to protect the cathode from metal dust. Welding could be started only after optimum focusing of the beam at its optimum power. Very intensive grain growth was observed in overheated molybdenum. This is shown in photographs of the metal structure. The macrostructure of both molten and powder molybdenum was similar, but the latter developed porosity. The ultimate strength of the welded joints at room temperature was 60% of the strength of base metal, but approached the strength of base metal upon increase of temperature and was equal to it at above 1000°C. The following welding conditions were found to be optimum for metal of different thicknesses (Table 2):

X

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D040/D112

Metal thickness, mm	Welding current (in the beam), mamp	Accelerating voltage, kv	Welding speed, m/hr
1	70 - 90	18 - 20	60
2	100 - 120	20 - 22	40
3	200 -- 250	20 - 22	30

Conclusions: (1) Electron-beam welding can be used for molybdenum and gives welds possessing greater plasticity and considerably less prone to cracks than welds made by arc welding in neutral gas. (2) Molybdenum is very sensitive to overheating and develops extremely large grains at temperatures above the recrystallization point. It has to be welded with the minimum consumption of electric power per weld length unit. (3) Welds in melted molybdenum are more plastic than in powder molybdenum. The higher gas content in powder molybdenum causes porosity of the welds. (4) The electron-beam welding techniques developed in the experiments ensure well shaped and sound welds in 1-3 mm thick molybdenum. There are 9 figures, 4 tables and 9 references: 6

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Electron-beam welding ... S/125/61/000/012/001/008
D040/D112

Soviet and 3 non-Soviet bloc. The two references to English-language publications read as follows: N.E. Weare, R.E. Monroe and D.C. Martin, Ductility of Tungsten-Arc Welds in Molybdenum, "Welding Journal", v. 36, no.6, 1957; L.N. Northcott, Molybdenum, London, 1956.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O.Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im.Ye.O. Paton, AS UkrSSR)

SUBMITTED: April 11, 1961

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GUREVICH, S.M.

Characteristics of the manufacture technology of fluxes for titanium alloy welding. Avton. svar. 14 no.12:88 D '61. (MIRA 14:11)

(Flux(Metallurgy))
(Titanium alloys--Welding)

OSTROVSKIY, S.A., kand. tekhn. nauk; RABKIN, D.M., kand. tekhn. nauk; MAKARA, A.M., kand. tekhn. nauk; SHEVERNITSKIY, V.V., kand. tekhn. nauk; ASNIS, A.Ye., kand. tekhn.nauk; POKHODNE, I.K., kand.tekhn. nauk; PODGAYETSKIY, V.V., kand.tekhn.nauk; PATON,B.Ye., laureat Leninskoy premii, akademik, doktor tekhn. nauk; BEL'FER,M.G., inzh.; MANDEL'BERG,S.L., kand.tekhn.nauk; MEDOVAR,B.I., doktor tekhn.nauk; GUREVICH,S.M., kand.tekhn.nauk; LATASH,Yu.V., kand.tekhn.nauk; KIRDO, I.V., kand.tekhn.nauk; SOROKA,M.S., red.; GORNOSTAYPOL'SKAYA, M.S., tekhn.red.

[Technology of electric fusion welding]Tekhnologiia elektricheskoi svarki plavleniem. Moskva, Mashgiz, 1962. 663 p. (MIRA 15:12)

1. Nauchnyye sotrudniki Instituta elektrosvarki imeni Ye.O.Patona (for all except Soroka, Gornostaypol'skaya).
(Electric welding)

GUREVICH, S.M.; DIDKOVSKIY, V.P.; TIKHOV, N.N. (Moskva)

Electric slag welding of BT5-1 titanium alloys. Avtom.svar. 15 no.5:78-84 My '62. (MIRA 15:4)

1. Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki imeni Ye.O.Patona AN USSR. (for Gurevich, Didkovskiy).

(Titanium alloys--Welding)

S/125/62/000/002/002/010
D040/D113

AUTHORS: Gurevich, S.M.; Grabin, V.F.

TITLE: Heat treatment of welds of VT6 alloy

PERIODICAL: Avtomaticheskaya svarka, no.2, 1962, 11-19

TEXT: The effect of different heat treatments on welds of BT 6 (VT6) alloy of Ti-Al-V class were studied experimentally using 6 mm thick VT 6 sheets welded with electrode wire of the same alloy and an AH-Tl (AN-Tl) flux. Heat treatment conditions were found by which welds with an ultimate strength of 120 kg/mm^2, good plasticity and toughness were obtained. The chemical composition of the VT 6 alloy is (in %): 6.0 Al, 4.1 V, 0.06 C, 0.20 Fe, 0.10 Si, 0.035 N_2, 0.008 O_2, 0.008 H_2. The composition of the weld metal in welding with the AN-Tl flux was practically the same as that of the base metal. Heat treatment consisted in water quenching from 700-1000°C, quenching with subsequent aging at 400 and 500°C, and annealing. Photo-micrographs of metal structure, obtained using an electron microscope, are included. References are

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S/125/62/000/002/002/010
Heat treatment of welds of VT6 alloy D040/D113

made to English- and French-language publications illustrating different opinions on the proper maximum heating temperature of VT6 type alloys. Conclusions: (1) Annealing at up to 800°C has practically no effect on the mechanical properties of welds of VT6 alloy, and the relief of the α matrix phase disappears; (2) Quenching from temperatures corresponding to the two-phase state range results in a partial replacement of the α phase by the α' phase; this has no perceptible effect on the mechanical properties; the quenching temperature must not exceed 850-900°C; (3) Step-by-step heat treatment, in contrast to continuous cooling, does not materially change the mechanical properties of VT6 welds; (4) The optimum strengthening heat treatment process is as follows: quenching from 850-900° with subsequent aging at 500-550°C for about 10 hours. There are 9 figures, 4 tables and 13 references: 6 Soviet and 7 non-Soviet-bloc. The four most recent English-language references are: P.D.Frost, Background for Practical Heat Treatment of Various Titanium Alloy Types, "Journal of Metals", v.8, no.1, 1956; Making Titanium Pressure Vessels, "Metal Industry", v.92, no.3, 1958; H.D. Kessler and R.G.Sherman, Heat Treating Titanium-Base Alloy Products, U.S. Patent 2804409, "Titanium Abstract Bulletin",

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S/125/62/000/002/002/010
D040/D113

v.3, no.6, 1957; I.I.Rausch, F.A.Crossley and H.D. Kessler, Titanium-Rich Corner of the Ti-Al-V System, "Journal of Metals", v.8, no.2, Section 2, 1956.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O.Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye.O.Paton,AS UkrSSR)

SUBMITTED: June 9, 1961

APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000617420014-6"

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37668
S/125/62/000/004/006/013
D040/D113

AUTHORS: Gurevich, S.M., and Yagupol'skaya, L.N.

TITLE: Effect of some alloy elements on the corrosion cracking of welds in titanium alloys

PERIODICAL: Avtomaticheskaya svarka, no. 4, 1962, 39-47

TEXT: Welds produced by the automatic process with argon shielding in 1.5-2 mm thick specimens of 41 different compositions of binary Ti-Sn, Ti-Zr and Ti-Mo alloys and their combinations with Al, Mn, Cr, V and Fe were tested for corrosion behavior under stress. A 99% nitric acid solution was used as a corrosive medium; stress was induced by bending close to the yield limit. The tests lasted up to 230 days. Details of tests and microscopic observations are given. Only Mo of all the tested alloy elements prevented the destruction of binary alloys. Additions of a third element as α-stabilizer (Al, Sn) or as β-stabilizer (Fe, Cr, V) eliminated the

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S/125/62/000/004/006/013
D040/D113

Effect of some alloy elements ...

effect of Mo. It is assumed that the anticorrosion effect of Mo is due to the formation of a peculiar and highly homogeneous fine-plate structure which resists corrosion much better than the coarse martensitic structure formed in metal alloyed with other elements. However, several Soviet specialists stated that the effect of alloying elements on the corrosion behavior of Ti could be explained either by the chemical stability of these elements and their presence in the protecting surface films, or by reduced anode effect. It was previously stated that Mo raised the resistance of welds in Ti to hydrogen embrittlement and cold cracking. Conclusions: (1) Alloying of titanium by zirconium or tin does not eliminate the tendency of alloys and welds to corrosion cracking under stress in 99% nitric acid; (2) binary Ti-Mo alloys and welds of such alloys have a high corrosion resistance under stress in such a medium; (3) the positive effect of Mo on the corrosion resistance of Ti welds is due to the peculiar structure of Ti alloyed with Mo. There are 6 figures and 4 tables.

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Effect of some alloy elements ... S/125/62/000/004/006/013
D040/D113

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O.Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye.O.Paton, AS UkrSSR)

SUBMITTED: July 1, 1961

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35670
S/125/62/000/005/008/010
D040/D113

1.2300
AUTHORS: Gurevich, S.M. and Didkovskiy, V.P. (see Association); Tikhov, N.N. (Moscow)

TITLE: Electroslag welding of titanium alloy VT5-1

PERIODICAL: Avtomaticheskaya svarka, no. 5, 1962, 78-84

TEXT: The described experiments were conducted in connection with the introduction of electroslag welding in the industrial lot production of large parts of BT5-1 (VT5-1) alloy which is weldable and was hitherto used extensively for thin-sheet weldments. The alloy contains 4 - 5.5% Al and 2 - 3% Sn and has higher mechanical strength than other Ti alloys at continuous loads up to 500°C and during short-term heating at 900°C. The experiments were conducted with forged and pressed rectangular billets with cross-sections varying from 40 by 42 to 60 by 70 mm and welding rings 60 by 70 mm in cross-section. Sound joints were obtained with forged billets using the following data of welding: 1600 - 1800 amp, 14 - 16 v, 26 mm wide gap, 130 g of AH-T 2 (AN-T2) flux and argon

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shielding at a rate of 8.0 l/min. The mechanical properties of pressed billets welded with the use of pressed unalloyed ВТ 1-1 (VT1-1) titanium were inconstant, but it is supposed that electrodes of the same chemical composition as that of the base metal will give joints of satisfactory strength and plasticity. All welding was conducted with plate electrodes. Rings were welded from two halves in an automatic process on a welding unit with rotary table. Welding one joint in rings took 4-5 min. No defects were found in welds on X-ray inspection and after machining. Conclusions: (1) Large parts of VT5-1 can be welded by electroslag process using an AN-T2 flux; (2) welded joints produced with VT5-1 plate electrodes in forgings are as strong as the base metal and have sufficient plasticity and toughness; (3) the plasticity and toughness of welds of pressed VT5-1 elements must be increased; (4) electroslag welding of various sizes of rings made of VT5-1 alloy has been introduced into serial production. There are 7 figures and 4 tables.

ASSOCIATION: Ordena Trudovogo Krasnogo Znameni Institut elektrosvarki im. Ye.O. Patona AN USSR (Electric Welding Institute "Order of the Red Banner of Labor" im. Ye.O. Paton, AS UkrSSR) (S.M. Gurevich and V.P. Didkovskiy)

S/598/62/000/007/033/040
D217/D307

18.1295

AUTHOR: Gurevich, S. M.

TITLE: Weldability of the titanium alloys АТ3 (AT3), AT4, AT6 and AT8

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Titan i yego splavy. no. 7, Moscow, 1962. Metallokhimiya i novyye splavy, 240-245

TEXT: The weldability of complex alloyed Ti alloys of the AT series was studied, with the participation of S. D. Zagrebenyuk, V. P. Didkovskiy, Yu. K. Novikov and L. N. Yagupol'skaya. Plates of 3 - 18 mm thickness were automatically welded using the oxygen-free flux АН-Т1 (AN-T1) and electrode wire of unalloyed Ti ВТ1 (VT1) of 3 mm diameter. Butt joints of metal 3 - 10 mm thick were welded in one pass, without chamfering the edges. Thicker metal was welded by joints on both sides. Forgings of 55 x 75 mm cross-section were joined by electric slag welding, using the oxygen-free flux AN-T2 and electrode plates 12 mm thick of the same composition as the

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Weldability of the ... S/598/62/000/007/033/040
D217/D307

basis metal. It was found that the welded joints of the alloys AT3 and AT4 had entirely satisfactory plasticity and ductility properties, as well as sufficient strength. Joints of the alloys AT6 and AT8 possess a lower plasticity and ductility. The electroslag welded joints of alloy AT3 possess a greater plasticity and ductility than those of alloy AT8. Heat treatment has virtually no effect on the mechanical properties of the welded joints. The corrosion resistance of the welded joints was investigated, It was found that the resistance of welded joints of the alloys AT3, AT4, AT6 and AT8 does not differ from that of the alloys OT4 (OT4), BT6 (VT6) and several others. The welded joints of the investigated alloys of the AT series were found to be stable towards aggressive media resisted by welds in industrial alloys, but unstable towards those media capable of attacking the latter. There are 5 figures and 5 tables.

B

Card 2/2

GUREVICH, S.M.; ZAMKOV, V.N.

Welding titanium with steel. Avtom. svar. 15 no.8:21-26 Ag '62.
(MIRA 15:7)

1. Ordena Trudovogo Krasnogo Znameni institut elektrosvarki imeni Ye.O. Patona AN USSR.
(Titanium--Welding) (Steel--Welding)

GUREVICH, S.M.; KHARCHENKO, G.K.; GUREVICH, Ya.B.(Moskva)

Electron-beam welding of chromium. Avtom. svar. 15 no.12:56-59 D '62. (MIRA 16:2)

1. Ordena Trudovogo Krasnogo Znameni institut elektrosvarki imeni Ye.O. Patona AN UkrSSR (for Gurevich, S.M., Kharchenko).
(Chromium—Welding)
(Electron beams)

AID Nr. 994-4 20 June

ELECTROSLAG MELTING OF TITANIUM ALLOYS (USSR)

Gurevich, S. M., V. P. Didkovskiy, and Yu. K. Novikov. Avtomaticheskaya svarka, no. 4, Apr 1963, 27-33. S/125/63/000/004/005/011

The Electric Welding Institute, Ukrainian Academy of Sciences, has studied the electroslag melting of titanium alloys with special attention to the casting of ingots of oblong cross section. Consumable electrodes were compacted from titanium sponge of various degrees of purity. The melting was done under oxygen-free AH-T2 flux [unidentified] in an argon atmosphere. Alloying additions, when used, were added to the electrodes. The 12- to 15-kg round and flat ingots of BT1 titanium [commercial grade] and OT4 [2.0—3.5% Al, 1.0—2.0% Mn] and OT4-1 [1.0—2.5% Al, 0.8—2% Mn] alloys had a clean, smooth surface. Mechanical properties of the alloys, though dependent on the grade of titanium sponge used, were satisfactory even in alloys melted from low-purity sponge. The BT1 melted from TГ00 sponge [high-purity] had a tensile strength of 41.4 kg/mm², elongation of 29.9%, reduction of area of 65.2%, notch toughness of 17.0 kg-m/cm², and hardness H_B of 131. The corresponding figures for BT1 melted from TГ2 [low-grade] sponge were

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AID Nr. 994-4 20 June

ELECTROSLAG MELTING [Cont'd] S/125/63/000/004/005/011

54.1 kg/mm ^{2}, 24.8%, 43.9%, 9.4 kg-m/cm ^{2}, and 190. Similar results were obtained with OT4 and OT4-1 alloys. Generally it was found that alloys produced by a single electroslag melting have mechanical properties in the as-cast condition equal to those of the same alloys double-melted in a vacuum-arc furnace. Mechanical properties of ingots with oblong cross section were found to be the same as those of round ingots. Vacuum (10^{-4} mm Hg) annealing of electroslag-melted alloys produced no further improvement in mechanical properties. [WB]

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GUREVICH, S.M.

AID Nr. 994-9 20 June

MODIFICATION OF Ti WELDS (USSR)

Gurevich, S. M. Avtomaticheskaya svarka, no. 3, Mar 1963, 34-39.
S/125/63/000/003/005/012

The Electric Welding Institute imeni Ye. O. Paton has studied the effect of small additions of Re and B on the structure and mechanical properties of submerged-arc-welded joints in BT1-2 commercial-grade Ti plates 3 mm thick. The Re or B powders were applied along the joint, which was then welded under an AH-T1 flux [unidentified] with a BT1 commercial-grade Ti electrode wire 3 mm in diameter. Microscopic examination revealed that the coarse-grained columnar structure of a nonmodified joint becomes finer at an Re content of 0.3 to 0.6%. The 0.2% Re or 0.01 to 0.03% B eliminates the columnar structure almost completely. At 0.1 to 0.2% Re, instead of the acicular-laminar structure of the α'-phase, a disoriented sorbitelike structure is formed. Further increase of Re content coarsens the microstructure; at about 1% Re it becomes martensitelike acicular.

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AID Nr. 994-9 20 June

MODIFICATION OF Ti WELDS [Cont'd] S/125/63/000/003/005/012

Additions of B also produce disoriented structures, but they are somewhat different. The 0.2% Re increases hardness by 3 to 4%. At 1% Re, hardness increases by 14 to 16%, and tensile strength, from 60 to 72 kg/mm^2. Elongation and reduction of area are not affected. The bend angle, however, increases to 180° with an Re content of 0.2% and then drops sharply to 85° as Re content increases to 1%. The notch toughness increases from about 6 to 8kg-m/cm^2 as Re content increases from 0 to 1%, the most noticeable increase taking place at 0.2% Re content. The beneficial effect of Re on notch toughness is maintained at subzero temperatures: a weld with 0.2% Re at -183°C has a notch toughness of 5kg-m/cm^2, compared with 3 mkg/cm^2 for a nonmodified weld. Unlike Re, B decreases the notch toughness. An increase from 40 to 50% in the reduction of area and of the bend angle from 150 to 180° without significant change in tensile strength and elongation takes place at 0.01% B. A further increase of B considerably decreases ductility and increases tensile strength. In general, Re modifies Ti welds more effectively than B. The optimum Re content is about 0.2%, and the best way of introducing Re into the weld is through the electrode wire. [MS]

Card 2/2

GUREVICH, S.M.

Composition of the natural gases of the fields of the eastern section of the Karpinsk swell and the determination of their absolute age. Trudy MINKHiGP no.43:54-62 '63. (MIRA 17:4)

YAGUPOL'SKAYA, L.N.; GUREVICH, S.M.

Corrosion of weldments of titanium and its alloys in inorganic chloride solutions. Avtom. svar. 16 no.1:44-47 Ja '63.
(MIRA 16:2)

1. Institut elektrosvarki imeni Ye.O. Patona AN UkrSSR.
(Titanium—Welding) (Welding—Corrosion)

GUREVICH, S. M.

Welded joints in inoculated titanium. Avtom. svar. 16 no.3: 34-39 Mr '63. (MIRA 16:4)

1. Institut elektrosvarki imeni Ye. O. Patona AN UkrSSR.

(Titanium alloys—Metallurgy)
(Welding—Testing)

GUREVICH, S. M. (Dr. Tech.) and ZAMKOV, V. N. (Eng.) (Institute of electric welding)

"Welding of titanium with steel, bronze and aluminum." Concerning questions of direct welding of alloys of titanium with copper and also technology of welding of titanium alloys with aluminum. The possibility of welding of titanium with steel through a copper layer was demonstrated.

Report presented at the 1st All-Union Conference on welding of heterogeneous metals, at the Institute of Electric Welding im. Ye. O. Paton, 14-15 June 1963. (Reported in Avtomaticheskaya svarka, Kiev, No. 9, Sept 1963, pp 95-96 author, V. L. Ryabov)
JPRS 24,651 19 May 64

ACCESSION NR: AP4013083 S/0125/64/000/002/0054/0058

AUTHOR: Didkovskiy, V. P.; Grabin, V. F.; Gurevich, S. M.

TITLE: Electroslag welding of VT6-alloy forged pieces

SOURCE: Avtomaticheskaya svarka, no. 2, 1964, 54-58

TOPIC TAGS: electroslag welding, welding, VT6 alloy, VT6 alloy forging, VT6 alloy welding, titanium alloy, titanium alloy welding

ABSTRACT: Forged pieces 60 to 100 x 100 to 120mm made from VT6 titanium alloy (4.9%Al, 3.8%V, 0.21%Fe, 0.11%O, 0.11%Si, 0.03%N, 0.06%H, balance Ti) were welded by an A-550 machine under AN-T2 flux-slag in argon atmosphere. Plate electrodes 10-14 mm thick were used. Increasing the plasticity of the weld metal was attempted by (a) subsequent heat treatment of the welds filled with the base VT6 metal was ineffective; hence, VT6

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ACCESSION NR: AP4013083

electrodes can be regarded as acceptable only when these plasticity characteristics are tolerated: relative elongation, 5-6%; reduction of area, 15-20%. Welds of a strength equal to that of the base metal and of adequate plasticity were obtained with AT8 complex alloy and with composite electrodes consisting of VT1-1 and VT6 plates. Orig. art. has: 5 figures and 2 tables.

ASSOCIATION: Institut elektrosvarki im. Ye. O. Patona AN Ukr SSR (Institute of Electric Welding, AN UkrSSR)

SUBMITTED: 10Apr63 DATE ACQ: 26Feb64 ENCL: 00

SUB CODE: ML NO REF SOV: 005 OTHER: 005

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GUREVICH, S.M.; DIDKOVSKIY, V.P.; NOVIKOV, Yu.K.; FILORIK'YAN, B.K. (Moskva); ZASETSKIY, G.F. (Moskva); KRAVCHENKO, V.F. (Moskva); NOVIKOVA, A.A. (Moskva)

Properties of commercial titanium and alloys of the OT4-type prepared by electric slag melting. Avtom. svar. 16 no.4:27-33 Ap '63. (MIRA 16:4)

1. Institut elektrosvarki im. Ye.O.Patona An UkrSSR (for Gurevich, Didkovskiy, Novikov).
(Titanium—Electrometallurgy) (Zone melting)

GUREVICH, S.M.; DIDKOVSKIY, V.P.; NOVIKOV, Yu.K.

Making titanium alloy ingots by the electric slag method.
Avtom. svar. 16 no.10:37-42 O '63. (MIRA 16:12)

1. Institut elektrosvarki imeni Patona AN UkrSSR.

ACCESSION NR: AP4002090 S/0125/63/000/012/0040/0048

AUTHOR: Grabin, V. F.; Didkovskiy, V. P.; Gurevich, S. M.; Gordonnaya, A. A.

TITLE: Nature of ductility drop in electroslag-welded VT6 alloy joints

SOURCE: Avtomat. svarka, no. 12, 1963, 40-48

TOPIC TAGS: VT6 titanium alloy welding, titanium alloy electroslag welding, VT6 alloy weld property, VT6 alloy weld structure, electroslag welding, ductility drop, brittleness, VT6 titanium alloy, titanium, titanium alloy, alloy welding, titanium alloy welding, weld brittleness, weld structure, weld ductility, weld property

ABSTRACT: The reasons for the decrease in ductility of welds performed by electroslag welding of VT6 titanium alloy have been investigated by determining changes in microstructure and microhardness and by local spectral analysis. It was concluded that the main reason is the 0.7-1.0% higher concentration of vanadium in the grain boundaries of the welded zone than in the weld; the increase in concentration was proved by using a mass spectrometer. The concentration was found to be related to the rate of cooling of the weld. At cooling rates not lower than 4.5 degrees/second, minimum concentration results. It is concluded that the concentration in the boundaries at temperatures below the melting point proceeds with maximum intensity at 1200-1250 C, which

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ACCESSION NR: AP4002090

corresponds to the temperature ranges at which the diffusion mobility of the vanadium atoms is relatively high. Orig. art. has: 9 figures and 4 tables.

ASSOCIATION: Institut elektrosvarki im. Ye. O. Patona AN SSSR (Electric Welding Institute)

SUBMITTED: 05Feb63 DATE ACQ: 03Jan64 ENCL: 00

SUB CODE: ML, MA NO REF SOV: 011 OTHER: 002

Card 2/2

GUREVICH, S.M.; KUSHNIRENKO, N.A.

Characteristics of the structure and properties of welded joints in the VT14 titanium alloy. Avtom.svar. 17 no.1:34-38 Ja '64. (MIRA 17:3)

1. Institut elektrosvarki imeni Patona AN UkrSSR.

DIDKOVSKIY, V.P.; GRABIN, V.F.; GUREVICH, S.M.

Electric slag welding of VT6 alloy forgings. Avtom. svar. 17 no.2: 54-58 F '64. (MIRA 17:9)

1. Institut elektrosvarki im. Ye.O. Patona AN UkrSSR.

ACCESSION NR: AP4020100 S/0125/64/000/003/0029/0033

AUTHOR: Grabin, V. F. (Candidate of technical sciences); Gurevich, S. M. (Doctor of technical sciences)

TITLE: Effect of size of the initial base-metal grain upon the characteristics of weld-affected zone of two-phase titanium alloys

SOURCE: Avtomaticheskaya svarka, no. 3, 1964, 29-33

TOPIC TAGS: base metal, welding, electric welding, electric arc welding, weld affected zone, VT6 titanium alloy, TiAlV alloy, TiAlVMn alloy, TiMn alloy, AN-T1 flux

ABSTRACT: An experimental investigation of the permissible grain size of a Ti base which would still ensure a high quality of the weld-affected zone is reported. These three alloys were tested:

Alloy	% weight								
	Al	V	Mn	Si	Fe	C	O	N	H
VT6	6,0	4,0	—	0,3	0,15	0,1	0,15	0,05	0,011
1	2,5	9,7	3,3	0,3	0,15	0,1	0,15	0,05	0,012
2	—	—	6,4	0,3	0,15	0,1	0,15	0,05	0,012

ACCESSION NR: AP4020100

Various sizes of the base metal were obtained by heating the test plates in a vacuum furnace at 10^{-5} torr, 1,000C for 1, 4, and 10 hrs. Butt welds were made at 220-250 amp, 32-34 v across the arc, 47 m/hr speed. Subsequent mechanical tests revealed that with up to 0.026 mm^2 grain size, the strength, toughness, and plasticity practically did not vary; with a greater grain size, however, the strength and plasticity decreased. No brittleness was observed even at -196C. Aging tests showed that the decomposition of the metastable beta-phase occurred more quickly in fine-grained specimens. The effect of grain size upon the hardness was most pronounced after heat treatment. Although the maximum hardness was about the same for different grain sizes, the time of attaining this hardness was longer for a coarser grain. No crack was visible in the weld-affected zone of VT6; the alloy 2 showed transverse cracks whose number grew with the grain size. Orig. art. has: 3 figures and 3 tables.

ASSOCIATION: Institut elektrosvarki im. Ye. O. Patona AN UkrSSR (Institute of Electric Welding, AN UkrSSR)

SUBMITTED: 28Dec62 DATE ACQ: 31Mar64 ENCL: 00

SUB CODE: ML NO REF SOV: 002 OTHER: 000

Card 2/2

ACCESSION NR: AP4029260 S/0125/64/000/004/0093/0094

AUTHOR: Gurevich, S. M. (Doctor of technical sciences); Zamkov, V. N. (Engineer); Zagrebenyuk, S. D. (Engineer); Kushnirenko, N. A. (Engineer)

TITLE: Effect of rare-earth-bearing fluxes on the structure and characteristics of VT15-alloy welds

SOURCE: Avtomaticheskaya svarka, no. 4, 1964, 93-94

TOPIC TAGS: welding, titanium alloy, titanium alloy welding, welding flux, lanthanum fluoride flux, AN-T7 flux, VT17 welding wire, VT15 titanium alloy

ABSTRACT: It was found that lanthanum fluoride, as a part of the welding flux, is conducive to good weld formation, welding-process stability, slag-crust separation, etc. in welding important constructions made from titanium alloys. Experiments were conducted with fluxes that contained various proportions of LaF_3; AN-T7 refractory fused flux was taken as a basis. The oxygen content in a weld made by

ACCESSION NR: AP4029260

VT17 wire (VT15 base metal) was 0.17% and 0.10% with 0 and 40% LaF_3 in the flux, respectively. A weld obtained with an optimum content of LaF_3 also showed superior mechanical characteristics (table given). Orig. art. has: 1 figure and 2 tables.

ASSOCIATION: none

SUBMITTED: 00 DATE ACQ: 27Apr64 ENCL: 00

SUB CODE: ML NO REF SOV: 000 OTHER: 000

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GUREVICH, S.M.; BLASHCHUK, V. Ye.

Automatic welding under flux of the AT3 titanium alloy. Avtom. svar. 17 no.6:24-28 Je '64 (MIRA 18:1)

1. Institut elektrosvarki imeni Ye.O. Patona AN UkrSSR.